

BAB IV

PERENCANAAN BALOK BORDES

4.1 Perencanaan Balok Bordes

Data - data : $b := 150 \text{ mm}$ Tulangan utama D13 mm
 $h := 300 \text{ mm}$
 $d := h - (40 + 10 + 0.5 \cdot 13) = 243.5 \text{ mm}$
 daksen := $h - d = 56.5 \text{ mm}$
 $f_c := 20.75 \text{ Mpa}$ $\beta := 0.85$
 $f_y := 390 \text{ Mpa}$

$$\rho_b := 0.85 \cdot \beta \cdot \frac{f_c}{f_y} \cdot \left(\frac{600}{600 + f_y} \right) = 0.023$$

$$\rho_{\max} := 0.75 \rho_b = 0.017$$

$$\rho_{\min} := \frac{1.4}{f_y} = 0.0036$$

$$m := \frac{f_y}{0.85 \cdot f_c} = 22.11$$

Dari output perletakan tangga didapat :

$$q_u := 1362.01 \text{ kg/m}$$

$$\text{panjang balok tangga} \quad L_b := 3 \text{ m}$$

$$M_u := \frac{q_u \cdot L_b^2}{8 \cdot 100} = 15.32 \text{ kNm}$$

- Tulangan Lentur Tumpuan & Lapangan**

ambil $\delta := 0.4$

$$M_n := \frac{M_u \cdot 10^6}{0.8} = 19153265.63 \text{ Nmm}$$

$$R_n := \frac{(1 - \delta) M_n}{b \cdot d^2} = 1.29 \text{ N/mm}^2$$

$$(\rho - \rho_{\text{aksen}}) := \frac{\left(1 - \sqrt{1 - \frac{2m \cdot R_n}{f_y}} \right)}{m} = 0.0034$$

$$\rho_{\text{aksen}} := \frac{\delta \cdot M_n}{f_y \cdot (d - \text{daksen}) \cdot b \cdot d} = 0.0029$$

$$\rho := 0.0034 + 0.0029 = 0.0063 > \rho_{\min} = 0.0036$$

$$A_{sperlu} := \rho \cdot b \cdot d = 230.11 \text{ mm}^2$$

$$A_s := 0.785 \cdot 13^2 \cdot 4 = 530.66 \text{ mm}^2$$

$$s_1 := \frac{(150 - 80 - 20 - 2 \cdot 13)}{2 - 1} = 24 \text{ mm} \quad \blacksquare > \blacksquare \quad 25 \text{ mm} \quad \text{OK!!}$$

$$A_{saksenperlu} := \rho_{aksen} \cdot b \cdot d = 105.05 \text{ mm}^2$$

$$A_{st} := 0.785 \cdot 13^2 \cdot 2 = 265.33 \text{ mm}^2$$

pasang tul tarik 4D13 dan tulangan tekan 2D13

$$a := \frac{A_s \cdot f_y}{0.85 \cdot f_c \cdot b} = 78.23 \text{ mm} \quad \blacksquare > \blacksquare \quad t_p := 120 \text{ mm}$$

Analisa menggunakan balok persegi

$$M_n := \frac{A_s \cdot f_y \cdot \left(d - \frac{a}{2}\right)}{10^6} = 42.3 \text{ kNm}$$

$$M_n = 42.3 \text{ kNm} \quad \blacksquare \geq \blacksquare \quad M_u = 15.32 \text{ kNm} \quad \text{OK!!}$$

- Tulangan Geser Balok**

$$V_u := \frac{q_u \cdot L_b \cdot 10}{2} = 20430.15 \text{ N}$$

$$V_c := \frac{\sqrt{f_c} \cdot b \cdot d}{6} = 27729.88 \text{ N}$$

$$V_s := \frac{V_u}{0.75} - V_c = -489.68 \text{ N} \quad \text{Perlu tulangan minimum !!}$$

$$V_{smin} := \frac{b \cdot d}{3} = 12175 \text{ N}$$

$$\text{Bila dipasang tulangan } \Phi 8 \text{ sebagai sengkang, } A_v := 2 \cdot 0.785 \cdot 10^2 = 157 \text{ mm}^2$$

$$f_y := 240 \text{ Mpa}$$

$$s_{..} := \frac{A_v \cdot f_y \cdot d}{V_{smin}} = 753.6 \text{ mm}$$

sehingga dipakai tulangan $\Phi 10$ - 150 untuk tumpuan dan $\Phi 10$ - 200 untuk lapangan